

Gondwana University, Gadchiroli

Choice Based Credit System (CBCS) Syllabus

B. Sc. III

Subject: Electronics

Semester-V & VI

Board of Studies - Electronics
Gondwana University, Gadchiroli

W. E. From 2019-20

Scheme of Bachelor of Science for CBCS Semester Examination

Gondwana University, Gadchiroli

Subject : Electronics

Class	Semester	Paper	Teaching Scheme Per Week			Examination Scheme				
			Theory	Total	Practical	Theory Marks			Practical Marks	Total Marks
						Paper	Internal Assessment	Total		
B.Sc.I	I	I	3	6 + 1T*	6	50	10	120	30	150
		II	3			50	10			
	II	I	3	6 + 1T*	6	50	10	120	30	150
		II	3			50	10			
B.Sc.II	I	I	3	6 + 2T*	6	50	10	120	30	150
		II	3			50	10			
	II	I	3	6 + 2T*	6	50	10	120	30	150
		II	3			50	10			
B.Sc.III	I	I	3	6 + 2T*	6	50	10	120	30	150
		II	3			50	10			
	II	I	3	6 + 2T*	6	50	10	120	30	150
		II	3			50	10			

* Periods for Tutorials per batch.

**** The student should appear in the University practical examination otherwise he/she will be treated as a failed. However their internal marks will be carried forward.**

Pattern of Question Papers (UG)

Time : **3 Hours**

Maximum marks : **50**

Question No.		Marks Allotted
Que. 1	Either	
	From Unit - I	10
	Or	
	From Unit - I	10
Que. 2	Either	
	From Unit – II	10
	Or	
	From Unit - II	10
Que. 3	Either	
	From Unit - III	10
	Or	
	From Unit - III	10
Que. 4	Either	
	From Unit - IV	10
	Or	
	From Unit - IV	10
Que. 5	Solve any 10 out of 12 questions	10 marks
	(3 questions from each unit)	1 mark each

The above pattern is for all papers of each semester of B. Sc. III, w.e.f. 2019-2020.

Details of the Syllabus
B.Sc. (Third Year)
Subject: Electronics
Scheme for Semester-V
W.E.F. 2019-20

Paper	No. of Periods per week (48 minutes each)			Marks				
	Lecture	Practical	Tutorial	Theory	Internal Assessment	Theory Total	Practical	Total
Paper – I (Compulsory) (USELT09) Electronic Instrumentation	3			50	10			
Paper – II (Elective-I) (USELT10) C Programming-I OR Paper – II (Elective-II) (USELT11) Antenna Theory OR Paper – II (Elective-III) (USELT12) Biomedical Instrumentation	3	6	2	50	10	120	30	150

CHOICE BASED CREDIT SYSTEM
B.Sc. SEM V
ELECTRONICS
Paper – I (USELT09-DSE-1A) (Compulsory)
Electronic Instrumentation

Theory : 48 Lectures

Credit : 02

Unit-I

Basic Measurement Instruments: DC measurement - ammeter, voltmeter, ohm meter, AC measurement, Digital voltmeter systems (integrating and non-integrating). Digital Multimeter; Block diagram principle of measurement of I, V, C. Accuracy and resolution of measurement. Measurement of Impedance- A.C. bridges, General condition of bridge balance, Schering Bridge, Owens Bridge 12L

Unit-II

Oscilloscope: Block Diagram, CRT, Vertical Deflection, Horizontal Deflection. Screens for CRT, Oscilloscope probes, measurement of voltage, frequency and phase by Oscilloscope. Digital Storage Oscilloscopes. Single trace and dual trace CRO. 12L

Unit-III

Lock-in-amplifier: Basic Principles of phase locked loop (PLL), Phase detector (XOR & edge triggered), Voltage Controlled Oscillator, lock and capture. Basic idea of PLL. Lock-in-amplifier, Idea of techniques for sum and averaging of signals.

Signal Generators: Function generator, Pulse Generator, (Qualitative only). 12L

Unit-IV

Transducers: Classification of transducers, Basic requirement/characteristics of transducers, Active and Passive transducers, Resistive transducer, Capacitive transducer (variable air gap type), Inductive (LVDT) & piezoelectric transducers. Temperature transducers (thermistor and thermocouple), Light transducers (photo resistors & photovoltaic cells). 12L

Reference Books

1. W.D. Cooper and A. D. Helfrick, Electronic Instrumentation and Measurement Techniques, Prentice Hall (2005).
2. E.O. Doebelin, Measurement Systems: Application and Design, McGraw Hill Book - fifth Edition (2003).
3. David A. Bell, Electronic Devices and Circuits, Oxford University Press (2015).
4. Alan S. Morris, "Measurement and Instrumentation Principles", Elsevier (Butterworth Heinmann-2008).
5. S. Rangan, G. R. Sarma and V. S. Mani, Instrumentation Devices and Systems, Tata Mcgraw Hill (1998).
6. Introduction to measurements and instrumentation, 4th Edn., Ghosh, PHI Learning
7. Electronic Instrumentation by Kalsi

**B.Sc. SEM V
ELECTRONICS**

Paper – II (Elective I) (USELT10-DSE-1B)

C-Programming-I

Theory : 48 Lectures

Credit : 02

Unit-I

Concepts of Algorithm and Flowcharts, problem solving examples using algorithm and Flowchart. Types of Programming languages, Characteristics of higher level language, Compiler and Interpreter, Importance of C.

Constants, Variables and data Types: Character Set, C tokens, Keywords and Identifiers, Constants, Variables, Data types, Declaration of Variables, Defining symbolic constants.

Unit-II

Operators and Expressions: Arithmetic, Relational, Logical, Assignment, Increment and Decrement, Conditional, Bitwise and special operators.

Arithmetic Expression, Evaluation of Expression, Precedence of Operators and Associativity, Library Functions I/O Statements.

Unit-III

Managing Input and Output Operators: Reading a character, writing a character, formatted input, formatted output.

Decision making and branching: Decision making with IF statement, Simple IF statement, the IF ELSE statement, Nesting of IF ... ELSE statements, The ELSE IF ladder, the switch statement, the ternary (? :) Operator, the GOTO statement.

Unit-IV

Decision making and Looping: The WHILE statement, the DO statement, The FOR statement, Nesting in loop, Jumps in loops, Break and continue.

Reference Books:

1. Programming in BASIC by Balagurusamy,
2. ANSI C- Programming Balagurusamy,
3. Let us C Kanetkar,
4. C and C++ Kanetkar,
5. Programming in “C” and “C++” by, Mahapatra
6. Programming in “C” by Rajaraman.

**B.Sc. SEM V
ELECTRONICS**

Paper – II (Elective II) (USELT11-DSE-1B)

Antenna Theory

Theory : 48 Lectures

Credit : 02

Unit I

Introduction: Antenna as an element of wireless communication system, Antenna radiation mechanism, Types of Antennas, Fundamentals of EMFT: Maxwell's equations and their applications to antennas.

Unit II

Antenna Parameters: Antenna parameters: Radiation pattern (polarization patterns, Field and Phase patterns), Field regions around antenna, Radiation intensity, Beam width, Gain, Directivity, Polarization, Bandwidth, Efficiency and Antenna temperature.

Unit III

Antenna as a Transmitter/Receiver: Effective Height and Aperture, Power delivered to antenna, Input impedance. Radiation from an infinitesimal small current element, Radiation from an elementary dipole (Hertzian dipole), Reactive, Induction and Radiation fields, Power density and radiation resistance for small current element and half wave dipole antenna.

Unit IV

Radiating wire Structures (Qualitative idea only): Monopole, Dipole, Folded dipole, Loop antenna and Biconical broadband Antenna. Basics of Patch Antenna and its design. Examples of Patch antenna like bowtie, sectoral, fractal, etc.

Propagation of Radio Waves: Different modes of propagation: Ground waves, Space waves, Space Wave propagation over flat and curved earth, Optical and Radio Horizons, Surface Waves and Troposphere waves, Ionosphere, Wave propagation in the Ionosphere.

Reference Books:

1. Ballanis, Antenna Theory, John Wiley & Sons, (2003) 2nd Ed.
2. Jordan and Balmain, E. C., Electro Magnetic Waves and Radiating Systems, PHI, 1968 Reprint (2003) 3rd Ed.
3. Antenna and Wave Propagation, Yadava, PHI Learning.

**B.Sc. SEM V
ELECTRONICS**

Paper – II (Elective III) (USELT12-DSE-2A)

Biomedical Instrumentation

Theory : 48 Lectures

Credit : 02

Unit I

Basic Principles of Biomedical Electronics : Bioelectrical signals, distribution of electrical potentials in different parts of the body, their magnitude and relationship to the physical status, processing of bio-electronic signals, different transducers for data acquisition; man-instrument system, biometrics

Unit II

Recording Systems : General consideration of electronic recording: preamplifier, main amplifier and driver amplifier; considerations of noise; display systems: Oscilloscopes- long persistence, memory facility, multi-channel displays, flat panel displays, touch screens

Unit III

Patient Safety and imaging techniques : Electronic shock hazards in biomedical instrumentation, Leakage current; grounding techniques; patient monitoring systems: foetus monitoring system and ICU; Need for imaging human body, imaging techniques: NMR, MRI, ultrasonic, X-ray tomography, endoscope, flexible bronchoscope and gastro scope

Unit IV

Biomedical Instruments

Electro-encephalography (EEG), Electrocardiography (ECG), Electromyography (EMG), hemo-dialysis machine, traction, cardiac pacemakers, cardiac defibrillators; use of telemetry in diagnosis, Lasers in biomedical field

Reference Books:

1. Handbook of Biomedical Instrumentation –R. S. Khandpur, TMH, New Delhi
2. Biomedical Instrumentation – Leslie Cromwell, PHI Publication, New Delhi
3. Biomedical Engineering System – Leslie Cromwell, PHI Publication, New Delhi
4. Biomedical Phenomenon – Robert Plonsay, John Wiley & Sons
5. Computers in medicine – R. D. Lele, TMH, New Delhi
6. Introduction to Biomedical Equipment Technology: J. J. Carr and J. M. Brown, Pearson Education Asia Publication, Singapore

Theory Internal Assessment (20 marks)

Sr. No.	Internal Assessment	P – I	P – II	T (20)
01	Assignment	02	02	04
02	Class Test	05	05	10
03	Adaptive Participation in routine class activities / seminars etc.	03	03	06
	Total	10	10	20

Note: An Industrial visit / Study tour should be arranged for the student after semester-III.

PRACTICALS (Conducted by internal examiner) (USELP03)

It is divided into two sections i.e. Section-A and Section-B. At least five experiments from each section must be performed and the practical record book duly signed should be submitted at the time of examination. Each student is expected to perform one experiment from each section, in the University Examination. The duration of practical examination is six hours.

Mark Distribution :

	Record	Experiment	Viva	Total
Section – A	3	9	3	15
Section – B	3	9	3	15
			Total	30

List of Experiments:

Section A : Compulsory - Electronic Instrumentation

1. Study of Series type Ohmmeter
2. Study of Shunt type Ohmmeter
3. Study of DC multirange Ammeter.
4. Study of DC multirange Voltmeter.
5. Study of loading effect in Voltmeter (DC only).
6. Study of Schering Bridge.
7. Study of Owen's bridge.
8. Study/Use of CRO for measurement of voltage and frequency.
9. Study/Use of CRO for determination of frequency and phase.
10. To determine the Characteristics of LVDT.
11. To determine the Characteristics of Thermistors and RTD.
12. Measurement of temperature by Thermocouples.

Section-B: Elective-I - C-programming I

1. At least 2 programs based on C-operators and expressions.
2. At least 2 programs on Input / Output.
3. At least 2 programs on decision making and branching using if, if-else, switch statements.

4. At least 2 programs on decision making and branching using if, if-else, switch statements.
5. At least 2 programs on decision making and branching using nesting of if-else and else-if ladder.
6. At least 2 programs on decision making and looping using while statement.
7. At least 2 programs on decision making and looping using do-while statement.
8. At least 2 programs on decision making and looping using for statement.
9. At least 2 programs on nesting of loops.

Section-B: Elective-II - Antenna Theory

1. To study and plot the radiation pattern of simple dipole antenna .
2. To study and plot the radiation pattern of Half Wave dipole antenna .
3. To study and plot the radiation pattern of folded dipole antenna .
4. To study and plot the radiation pattern of 5 Element Yagi Uda antenna .
5. To study and plot the radiation pattern of Log Periodic antenna .
6. To study and plot the radiation pattern of Helical antenna 7.To study and plot the radiation pattern of cut parabolic antenna with simple dipole feed .
8. To study various types of parabolic reflectors and their feed systems .
9. To study and plot the radiation pattern of broad side antenna array .
10. To study and plot the radiation pattern of end fire antenna array .

Section-B: Elective-III - Biomedical Instrumentation

1. Design and study of op-amp based EEG signal amplifier.(input through simulation)
2. Design and study of electronic stethoscope
3. Design and study of body temperature measuring system
4. Design and study of respiratory rate measuring system
5. Design and study of arm pressure measuring system
6. Design of digital heart rate measuring system

Skill Enhancement Course (any one) (Credit: 02 each) SEC-1 to SEC-2

Electrical Circuits and Network Skills (SEC-1) (Credits: 02) Theory: 30 Lectures

The aim of this course is to enable the students to design and trouble shoots the electrical circuits, networks and appliances through hands-on mode

Unit I

Basic Electricity Principles: Voltage, Current, Resistance, and Power. Ohm's law. Series, parallel, and series-parallel combinations. AC and DC Electricity. Familiarization with multimeter, voltmeter and ammeter.

Electrical Circuits: Basic electric circuit elements and their combination. Rules to analyze DC sourced electrical circuits. Current and voltage drop across the DC circuit elements. Single-phase and three-phase alternating current sources. Rules to analyze AC sourced electrical circuits. Real, imaginary and complex power components of AC source. Power factor. Saving energy and money.

Unit II

Electrical Drawing and Symbols: Drawing symbols. Blueprints. Reading Schematics. Ladder diagrams. Electrical Schematics. Power circuits. Control circuits. Reading of circuit schematics. Tracking the connections of elements and identify current flow and voltage drop.

Generators and Transformers: DC Power sources. AC/DC generators. Inductance, capacitance, and impedance. Operation of transformers.

Unit III

Electric Motors: Single-phase, three-phase & DC motors. Basic design. Interfacing DC or AC sources to control heaters & motors. Speed & power of ac motor.

Solid-State Devices: Resistors, inductors and capacitors. Diode and rectifiers. Components in Series or in shunt. Response of inductors and capacitors with DC or AC sources

Unit IV

Electrical Protection: Relays. Fuses and disconnect switches. Circuit breakers. Overload devices. Ground-fault protection. Grounding and isolating. Phase reversal. Surge protection. Relay protection device.

Electrical Wiring: Different types of conductors and cables. Basics of wiring-Star and delta connection. Voltage drop and losses across cables and conductors. Instruments to measure current, voltage, power in DC and AC circuits. Insulation. Solid and stranded cable. Conduit. Cable trays. Splices: wirenuts, crimps, terminal blocks, and solder. Preparation of extension board.

Reference Books:

- Electrical Circuits, K.A. Smith and R.E. Alley, 2014, Cambridge University Press
- A text book in Electrical Technology - B L Theraja - S Chand & Co.
- A text book of Electrical Technology - A K Theraja
- Performance and design of AC machines - M G Say ELBS Edn.

Electronic Workshop Skill (SEC-2) (Credits: 02) 30 Lectures

The aim of this course is to enable the students to familiar and experience with various mechanical and electrical tools through hands-on mode

Unit I

Introduction: Measuring units. conversion to SI and CGS. Familiarization with meter scale, Vernier calliper, Screw gauge and their utility. Measure the dimension of a solid block, volume of cylindrical beaker/glass, diameter of a thin wire, thickness of metal sheet, etc. Use of Sextant to measure height of buildings, mountains, etc.

Unit II

Mechanical Skill: Concept of workshop practice. Overview of manufacturing methods: casting, foundry, machining, forming and welding. Types of welding joints and welding defects. Common materials used for manufacturing like steel, copper, iron, metal sheets, composites and alloy, wood. Concept of machine processing, introduction to common machine tools like lathe, shaper, drilling, milling and surface machines. Cutting tools, lubricating oils. Cutting of a metal sheet using blade. Smoothing of cutting edge of sheet using file. Drilling of holes of different diameter in metal sheet and wooden block. Use of bench vice and tools for fitting. Make funnel using metal sheet.

Unit III

Electrical and Electronic Skill: Use of Multimeter. Soldering of electrical circuits having discrete components (R, L, C, diode) and ICs on PCB. Operation of oscilloscope. Making regulated power supply. Timer circuit, Electronic switch using transistor and relay.

Unit IV

Introduction to prime movers: Mechanism, gear system, wheel, Fixing of gears with motor axel. Lever mechanism, Lifting of heavy weight using lever. braking systems, pulleys, working principle of power generation systems. Demonstration of pulley experiment.

Reference Books:

- A text book in Electrical Technology - B L Theraja – S. Chand and Company.
- Performance and design of AC machines – M.G. Say, ELBS Edn.
- Mechanical workshop practice, K.C. John, 2010, PHI Learning Pvt. Ltd.
- Workshop Processes, Practices and Materials, Bruce J Black 2005, 3rd Edn., Editor Newnes [ISBN: 0750660732]
- New Engineering Technology, Lawrence Smyth/Liam Hennessy, The Educational Company of Ireland [ISBN: 0861674480]

Scheme of Examination for Skill Enhancement Course SEC-1 to SEC-2

Course Scheme					Examination Scheme		
Lecturers	Tutorial(s)	Practical	Period Per Week	Credits	MSE	IE	Total
2	0	0	2	2	30	70	100

The examination to be conducted at the end of the semester i.e. MSE for 30 marks. The examination paper shall be having MCQs / Short answer type questions. The IE consisting of 70 marks will be in the form of Report to be submitted based on field work / Practical Work / Project Work done.

The result would be declared in the form of Grades as shown below:

Grade 'O' for score above 75; A:61-75; B:51-60; C:40-50

Details of the Syllabus
B.Sc. (Third Year)
Subject: Electronics
Scheme for Semester-VI

W.E.F. 2019-20

Paper	No. of Periods per week (48 minutes each)			Marks				
	Lecture	Practical	Tutorial	Theory	Internal Assessment	Theory Total	Practical	Total
Paper – I (USELT13) (Compulsory) Photonic Devices and Power Electronics	3			50	10			
Paper – II (Elective-I) (USELT14) C Programming-II OR Paper – II (Elective-II) (USELT15) Antenna Theory OR Paper – II (Elective-III) (USELT16) Biomedical Instrumentation	3	6	2	50	10	120	30	150

**B.Sc. SEM VI
ELECTRONICS**

**Paper – I (USELT13) (Compulsory)
Photonic Devices and Power Electronics**

Theory : 48 Lectures

Credit : 02

Unit I

Classification of photonic devices. Interaction of radiation and matter, Radiative transition and optical absorption. Light Emitting Diodes- Construction, materials and operation. Semiconductor Laser- Condition for amplification, laser cavity, heterostructure and quantum well devices. Charge carrier and photon confinement, line shape function. Threshold current. Laser diode. 12L

Unit II

Photodetectors: Photoconductor. Photodiodes (p-i-n, avalanche) and Photo transistors, quantum efficiency and responsivity. Photomultiplier tube.

Solar Cell: Construction, working and characteristics

LCD Displays: Types of liquid crystals, Principle of Liquid Crystal Displays, applications, advantages over LED displays. 12L

Unit III

Power Devices: Need for semiconductor power devices, Power MOSFET (Qualitative).

Introduction to family of thyristors. Silicon Controlled Rectifier (SCR)- structure, I-V characteristics, Turn-On and Turn-Off characteristics, ratings, Gate-triggering circuits.

Diac and Triac- Basic structure, working and V-I characteristics. Application of Diac as a triggering device for Triac. 12L

Unit IV

Applications of SCR: Phase controlled rectification, AC voltage control using SCR and Triac as a switch. Power Invertors- Need for commutating circuits and their various types, dc link invertors, Parallel capacitor commutated invertors, Series Invertor, limitations and its improved versions, bridge invertors. 12 L

Reference Books:

1. J. Wilson & J.F.B. Hawkes, Optoelectronics: An Introduction, Prentice Hall India (1996)
2. S.O. Kasap, Optoelectronics & Photonics, Pearson Education (2009)
3. AK Ghatak & K Thyagarajan, Introduction to fiber optics, Cambridge Univ. Press (1998)
4. Power Electronics, P.C. Sen, Tata McGraw Hill
5. Power Electronics, M.D. Singh & K.B. Khanchandani, Tata McGraw Hill
6. Power Electronics Circuits, Devices & Applications, 3rd Edn., M.H. Rashid, Pearson Education
7. Optoelectronic Devices and Systems, Gupta, 2nd edn., PHI learning.
8. Electronic Devices and Circuits, David A. Bell, 2015, Oxford University Press.

**B.Sc. SEM VI
ELECTRONICS**

Paper – II (USELT14) (Elective I)

C-Programming-II

Theory: 48 Lectures

Credit:02

Unit-I:

Arrays and User Defined Function : One-dimensional arrays, Two-dimensional arrays, Initialization of two dimensional arrays, Concept of Multidimensional arrays.

Need for User Defined Functions, Concept Associated with Functions, Return Values and Their Types. Category of functions: No arguments and no return values, arguments but no return values, arguments with return values.

Nesting of functions, recursion, Scope and Lifetime of Variables in Function. 12 L

Unit-II:

Structure, Unions and Pointers : Basic Concept of Structure, Operations on Structure, Array of Structure, Union, Difference in union and Structure.

Basic Concept of pointers, Pointer Expression, Pointers and arrays, Pointer and Character String, Pointer to Function. 12 L

Unit-III:

File management: Introduction, Defining and Opening File, Closing a File, I/O Operations on File. Error Handling, Random Access to Files, Command Line Arguments. 12 L

Unit-IV

Principle of Object Oriented Programming, Software evaluation, Oop paradigm. Basic concept of Oop, Benefits of Oop, Application of Oop. Introduction to C++, Applications of C++, Difference between C and C++.

C++: Tokens, Keywords, Identifiers, Constants, Variables, Basic data types.

Operators in C++ : cin, cout, new, delete, Manipulators, Operators overloading, Simple C++ programs. 12 L

Reference Books:

1. ANSI C- Programming ,by Balaguruswamy,
2. Object Oriented Programming with C++ by Balaguruswamy,
3. C++ , by Yashwant Kanetkar,
4. Let Us “C”, by Yashwant Kanetkar.
5. Programming in “C” and”C++”, by Mahapatra
6. Programming in “C”, by Rajaraman.

**B.Sc. SEM VI
ELECTRONICS**

Paper – II (USELT15) (Elective I)

Wireless Networks

Theory: 48 Lectures

Credit:02

Unit I

Introduction: History of wireless communication, Wireless Generation and Standards, Cellular and Wireless Systems, Current Wireless Systems, Cellular Telephone Systems, Wide Area Wireless Data Services, Broadband Wireless Access, Satellite Networks, Examples of Wireless Communication Systems. Idea about Global Mobile communication system.

Unit II

Modern Wireless Communication Systems: Second Generation (2G) Cellular Networks, Third Generation (3G) Wireless Networks, Wireless Local Loop (WLL), Wireless Local Area Networks (WLANs), Bluetooth and Personal Area Networks (PANs). Idea about Wi-Fi, 4G and LTE, and 5G.

Unit III

Cellular Concept and System Design Fundamentals: Cellular Concept and Cellular System Fundamentals, Frequency Reuse, Channel Assignment Strategies, Handoff strategies, Interference and System Capacity,

Unit IV

Trunking and Grade of Service. Improving Coverage & Capacity in Cellular Systems. Cell Splitting and Sectoring. Cellular Systems design Considerations (Qualitative idea only).

Reference Books:

1. Andrea Goldsmith, Wireless communications, (2015) Cambridge University Press
2. D. Tse and P. Viswanathan, Fundamentals of Wireless Communication, (2014) Cambridge University Press.
3. Wireless communication and Networks, Upena Dala, 2015, Oxford University Press.
4. Haykin S. & Moher M., Modern Wireless Communication, Pearson, (2005) 3rd Ed.
5. Lee, William C.Y., Mobile Communication Design and Fundamentals, (1999) 4th Ed

**B.Sc. SEM VI
ELECTRONICS**

Paper – II (USELT15) (Elective I)

Digital Signal Processing

Theory: 48 Lectures

Credit:02

Unit I

Discrete-Time Signals and Systems: Classification of Signals, Transformations of the Independent Variable, Periodic and Aperiodic Signals, Energy and Power Signals, Even and Odd Signals, Discrete-Time Systems, System Properties. Impulse Response, Convolution Sum; Graphical Method; Analytical Method, Properties of Convolution; Commutative; Associative; Distributive; Shift; Sum Property System Response to Periodic Inputs, Relationship Between LTI System Properties and the Impulse Response; Causality; Stability; Invertibility, Unit Step Response.

Unit II

Discrete-Time Fourier Transform: Fourier Transform Representation of Aperiodic Discrete-Time Signals, Periodicity of DTFT, Properties; Linearity; Time Shifting; Frequency Shifting; Differencing in Time Domain; Differentiation in Frequency Domain; Convolution Property.

Unit III

The z -Transform: Bilateral (Two-Sided) z -Transform, Inverse z -Transform, Relationship Between z -Transform and Discrete-Time Fourier Transform, z -plane, Region-of-Convergence; Properties of ROC, Properties; Time Reversal; Differentiation in the z -Domain; Power Series Expansion Method (or Long Division Method); Analysis and Characterization of LTI Systems; Transfer Function and Difference-Equation System. Solving Difference Equations.

Unit IV

Filter Concepts: Phase Delay and Group delay, Zero-Phase Filter, Linear-Phase Filter, Simple FIR Digital Filters, Simple IIR Digital Filters, All pass Filters, Averaging Filters, Notch Filters.

Reference Books:

1. Digital Signal Processing, Tarun Kumar Rawat, 2015, Oxford University Press, India
2. Digital Signal Processing, S. K. Mitra, McGraw Hill, India.
3. Principles of Signal Processing and Linear Systems, B.P. Lathi, 2009, 1st Edn. Oxford University Press.
4. Fundamentals of Digital Signal processing using MATLAB, R.J. Schilling and S.L. Harris, 2005, Cengage Learning.
5. Fundamentals of signals and systems, P.D. Cha and J.I. Molinder, 2007, Cambridge University Press.
6. Digital Signal Processing Principles Algorithm & Applications, J.G. Proakis and D.G. Manolakis, 2007, 4th Edn., Prentice Hall.

Theory Internal Assessment (20 marks)

Sr. No.	Internal Assessment	P – I	P – II	T (20)
01	Assignment	02	02	04
02	Class Test	05	05	10
03	Adaptive Participation in routine class activities / seminars etc.	03	03	06
	Total	10	10	20

PRACTICALS (Conducted by internal examiner) (USELP04)

It is divided into two sections i.e. Section-A and Section-B. At least five experiments from each section must be performed and the practical record book duly signed should be submitted at the time of examination. Each student is expected to perform one experiment from each section, in the University Examination. The duration of practical examination is six hours.

Mark Distribution :

	Record	Experiment	Viva	Total
Section – A	3	9	3	15
Section – B	3	9	3	15
			Total	30

List of Experiments:

Section A (Compulsory) : Photonic Devices and Power Electronics

1. To determine characteristics of (a) LEDs, (b) Photo voltaic cell and (c) Photo diode.
2. To study the Characteristics of LDR and Photodiode with (i) Variable Illumination intensity, and (ii) Linear Displacement of source.
3. Output and transfer characteristics of a power MOSFET.
4. Study of I-V characteristics of SCR
5. SCR as a half wave and full wave rectifiers with R and RL loads.
6. AC voltage controller using TRIAC with UJT triggering.
7. Study of I-V characteristics of DIAC
8. Study of I-V characteristics of TRIAC

Section-B (Elective-I) : C-programming II

1. Programs on one dimensional array.
2. Programs on two dimensional arrays.
3. Programs on user defined functions (No argument no return value).
4. Programs on user defined functions (Argument but no return value).
5. Programs on user defined functions (Argument with return value).
6. Programs on user defined functions (Nesting of function).
7. Programs on user defined functions (Recursion).
8. Programs on Structure.
9. Programs on arrays and structure.
10. Programs on Unions
11. Programs on pointers.
12. Programs on Pointers and arrays
13. Programs on Pointer to Function
14. Programs on file management.

Section-B (Elective-II) : Wireless Networks

1. To verify the inverse square law of propagation: to measure the variation of the strength of radiated wave, with distance from transmitting antenna.
2. Measure parameter of dipole/folded dipole antenna:
 - a) To plot the radiation pattern of the dipole antenna in azimuth and elevation planes on log and linear scales on polar and Cartesian plots.
 - b) To measure the beam width(-3dB), front -to- back ratio, side lobe level & its angular position, plane of polarization & directivity and gain of the dipole antenna.
3. To demonstrate that the transmitting and receiving radiation patterns of an antenna are equal and hence confirm the reciprocity theorem of antenna.
4. To study the characteristics of Broadside array.
5. To measure various parameters of log periodic antenna using radiation pattern.
6. To measure various parameter of slotted antenna using radiation patterns.
7. To study the frequency dependent and independent antenna.
8. To study the characteristic features of end fire array.
9. To study the characteristic features of micro strip antenna.
10. To measure the phenomenon of linear and circular polarization of antennas.
11. To study an antenna design simulation software

Section-B (Elective-III) : Digital Signal Processing

1. Write a program to generate and plot the following sequences: (a) Unit sample sequence $\delta(n)$, (b) unit step sequence $u(n)$, (c) ramp sequence $r(n)$, (d) real valued exponential sequence $x(n) = (0.8)^n u(n)$ for $0 \leq n \leq 50$.

2. Write a program to compute the convolution sum of a rectangle signal (or gate function) with itself for $N = 5$

$$x(n) = \text{rect}\left(\frac{n}{2N}\right) = \Pi\left(\frac{n}{2N}\right) = \begin{cases} 1 & -N \leq n \leq N \\ 0 & \text{otherwise} \end{cases}$$

3. An LTI system is specified by the difference equation

$$y(n] = 0.8y(n-1) + x(n)$$

(a) Determine $H(e^{j\omega})$

(b) Calculate and plot the steady state response $y_{ss}(n)$ to

$$x(n) = \cos(0.5\pi n)u(n)$$

4. Given a casual system

$$y(n] = 0.9y(n-1) + x(n)$$

(a) Find $H(z)$ and sketch its pole-zero plot

(b) Plot the frequency response $|H(e^{j\omega})|$ and $\angle H(e^{j\omega})$

5. Design a digital filter to eliminate the lower frequency sinusoid of $x(t) = \sin 7t + \sin 200t$. The sampling frequency is $f_s = 500 \text{ Hz}$. Plot its pole zero diagram, magnitude response, input and output of the filter.

6. Let $x(n)$ be a 4-point sequence:

$$x(n) = \begin{matrix} \{1,1,1,1\} \\ \uparrow \\ \{1 & 0 \leq n \leq 3 \\ 0 & \text{otherwise} \end{matrix}$$

Compute the DTFT $X(e^{j\omega})$ and plot its magnitude

(a) Compute and plot the 4 point DFT of $x(n)$

(b) Compute and plot the 8 point DFT of $x(n)$ (by appending 4 zeros)

(c) Compute and plot the 16 point DFT of $x(n)$ (by appending 12 zeros)

7. Let $x(n)$ and $h(n)$ be the two 4-point sequences,

$$x(n) = \begin{matrix} \{1,2,2,1\} \\ \uparrow \\ \{1, -1, -1, 1\} \\ \uparrow \end{matrix}$$

Write a program to compute their linear convolution using circular convolution.

Skill Enhancement Course (any one) (Credit: 02 each) SEC-3 to SEC-4

Renewable Energy and Energy Harvesting (SEC-3)

(Credits: 02) Theory:30 Lectures

The aim of this course is not just to impart theoretical knowledge to the students but to provide them with exposure and hands-on learning wherever possible

Unit I

Fossil fuels and Alternate Sources of energy: Fossil fuels and nuclear energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity.

Solar energy: Solar energy, its importance, storage of solar energy, solar pond, non convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems.

Unit II

Wind Energy harvesting: Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies.

Ocean Energy: Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices.

Unit III

Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power, Ocean Bio-mass.

Geothermal Energy: Geothermal Resources, Geothermal Technologies.

Hydro Energy: Hydropower resources, hydropower technologies, environmental impact of hydro power sources.

Unit IV

Piezoelectric Energy harvesting: Introduction, Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity, Piezoelectric parameters and modeling piezoelectric generators, Piezoelectric energy harvesting applications, Human power

Electromagnetic Energy Harvesting: Linear generators, physics mathematical models, recent applications Carbon captured technologies, cell, batteries, power consumption. Environmental issues and Renewable sources of energy, sustainability.

Reference Books:

- Non-conventional energy sources, B.H. Khan, McGraw Hill
- Solar energy, Suhas P Sukhative, Tata McGraw - Hill Publishing Company Ltd.
- Renewable Energy, Power for a sustainable future, Godfrey Boyle, 3rd Edn., 2012, Oxford University Press.
- Renewable Energy Sources and Emerging Technologies, Kothari et.al., 2nd Edition, PHI Learning.
- Solar Energy: Resource Assesment Handbook, P Jayakumar, 2009
- J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).
- http://en.wikipedia.org/wiki/Renewable_energy

Weather Forecasting (SEC-4) (Credits : 02) Theory: 30 Lectures

The aim of this course is not just to impart theoretical knowledge to the students but to enable them to develop an awareness and understanding regarding the causes and effects of different weather phenomenon and basic forecasting techniques

Unit I

Introduction to atmosphere: Elementary idea of atmosphere: physical structure and composition; compositional layering of the atmosphere; variation of pressure and temperature with height; air temperature; requirements to measure air temperature; temperature sensors: types; atmospheric pressure: its measurement; cyclones and anticyclones: its characteristics.

Unit II

Measuring the weather: Wind; forces acting to produce wind; wind speed direction: units, its direction; measuring wind speed and direction; humidity, clouds and rainfall, radiation: absorption, emission and scattering in atmosphere; radiation laws.

Weather systems: Global wind systems; air masses and fronts: classifications; jet streams; local thunderstorms; tropical cyclones: classification; tornadoes; hurricanes.

Unit III

Climate and Climate Change: Climate: its classification; causes of climate change; global warming and its outcomes; air pollution; aerosols, ozone depletion, acid rain, environmental issues related to climate.

Unit IV

Basics of weather forecasting: Weather forecasting: analysis and its historical background; need of measuring weather; types of weather forecasting; weather forecasting methods; criteria of choosing weather station; basics of choosing site and exposure; satellites observations in weather forecasting; weather maps; uncertainty and predictability; probability forecasts.

Reference books:

1. Aviation Meteorology, I.C. Joshi, 3rd edition 2014, Himalayan Books
2. The weather Observers Hand book, Stephen Burt, 2012, Cambridge University Press.
3. Meteorology, S.R. Ghadekar, 2001, Agromet Publishers, Nagpur.
4. Text Book of Agro meteorology, S.R. Ghadekar, 2005, Agromet Publishers, Nagpur
5. Atmosphere and Ocean, John G. Harvey, 1995, The Artemis Press.

Scheme of Examination for Skill Enhancement Course SEC-3 to SEC-4

Course Scheme					Examination Scheme		
Lecturers	Tutorial(s)	Practical	Period Per Week	Credits	MSE	IE	Total
2	0	0	2	2	30	70	100

The examination to be conducted at the end of the semester i.e. MSE for 30 marks. The examination paper shall be having MCQs / Short answer type questions. The IE consisting of 70 marks will be in the form of Report to be submitted based on field work / Practical Work / Project Work done.

The result would be declared in the form of Grades as shown below:

Grade 'O' for score above 75; A:61-75; B:51-60; C:40-50